

American Potato Journal

Volume XII

February, 1935

Number 2

POTATO MARKETING AGREEMENTS

KRIS P. BEMIS

Senior Marketing Specialist, General Crops Section, Agricultural Adjustment Administration, United States Department of Agriculture, Washington, D. C.

While the demand for some form of stabilization of the potato industry has always arisen in periods of low prices like the present, certain factors inherent in the business have seemed practically beyond the control of potato producers or distributors. Years of favorable prices have almost always been followed by increased acreage, increased production and unprofitable returns to all concerned. The necessity for some form of control of the potato crop is beginning to be quite generally admitted by leaders in the industry not only because of the present depressed market conditions, but because of long experience with cycles of unbalanced production. There is, however, a lack of agreement as to what form of control should be adopted.

The development of control programs for staple food crops, such as wheat, corn, hogs and other commodities, has turned the attention of potato growers towards the possibilities of a similar program for their product. Potatoes rank first in volume and importance among all vegetable crops, and compare favorably with the large grain crops from the standpoint of value as foodstuffs.

The Agricultural Adjustment Administration, in administering the Agricultural Adjustment Act, is required by that law to attempt to establish and maintain such balance between the production and consumption of agricultural commodities, and marketing conditions therefore as will re-establish prices to farmers at a level equivalent to the purchasing power of agricultural commodities in the base period. The Act defines the base period as the pre-war period from August, 1909-July, 1914. In carrying out the purposes of the Act, the Administration is obliged

*Given before the Potato Association of America, at Pittsburgh, on December 28, 1934

to follow methods of procedure which the law outlines. In the case of crops designated as basic commodities, the Secretary of Agriculture has power to provide for reduction in acreage, or reduction in the production for market, or both, of such basic commodities through agreements with producers, or by other voluntary methods, and to provide for rental or benefit payments in connection therewith, in such amounts as he may deem fair and reasonable.

For crops not designated by the Act as basic commodities, the Secretary of Agriculture is empowered, after due notice and opportunity for hearing, to enter into marketing agreements with processors, producers, associations of producers, and others engaged in the handling of such commodities in interstate commerce, and to issue licenses permitting such processors, associations of producers, producers, and others to handle such commodities in interstate commerce. It is evident, therefore, that the Agricultural Adjustment Administration must follow, in any crop control program, the provisions of the Act under which it was created. For this reason the potato program has been approached through the development of marketing agreements.

The demand for some control of potato marketing arose in the Southeastern States in the fall of 1933. Growers in the Carolinas and Virginia faced a low market at the beginning of the 1934 season because of increased acreage and heavier yields. The practice of contract planting by various supply dealers, fertilizer companies and shippers is blamed by the Southeastern producers for much of the increased acreage.

The Administration was requested to cooperate with representatives of the industry in the Southeast in preparing a potato marketing agreement, and such an instrument was made effective as to the Eastern Shore of Virginia, Eastern Shore of Maryland, and the Norfolk, Virginia area on July 13, 1934. The agreement was effective only during the last three weeks of the shipping season, and, while it resulted in some benefits in the way of limitation of shipments, it was hardly in effect long enough to accomplish the fullest results.

At the same time a marketing agreement was prepared by representatives of the industry in Kansas and Missouri and was tentatively approved, but owing to the crop failure in those states on account of drought, it was not signed by the industry.

The Triumph-producing states along the Gulf and the potato areas in Texas and Oklahoma, prepared a similar marketing agreement which has been the subject of public hearings during the fall months of this year. While contract planting is not an important factor in that area, the industry in the Southwest has felt that some degree of coordina-

tion ought to be achieved between themselves and the producers of the Southeast.

The Administration has completed a series of eleven public hearings in connection with the marketing agreements, and is now in a position to revise and present them for the industry's approval. The industry seems to desire two agreements; one for the Southeastern States, from Maryland south to and including Florida; and another for the Southwestern States, from Kansas and Missouri southward to and including Texas, Louisiana, Mississippi and Alabama. If adopted in the form requested by shippers and producers, the agreements would provide for a Control Committee in each region made up equally of producers and shippers. Provision would be made whereby the Control Committees of both regions might meet in advance of planting time, and establish a season prorate for both regions which would be the total number of cars advisable to ship from each region under either agreement during the ensuing season. The season allotment would be divided between the two regions on the basis of their average carlot shipments for the preceding five years, and a similar allocation would be made by each Control Committee to each of the districts under each agreement on the same basis.

Provision would be made for a district proration committee in each district under each agreement, such committees to be made up of equal numbers of producers and shippers with a disinterested member chosen in each district by each group. The district proration committees of districts having shipments ready at the same time during the shipping season could regulate shipments in such a way as not to oversupply the markets during such proration periods as they might establish. Such proration would be based upon the percentage which the total advisable shipments was of the total available supply during the period. The total available supply would be determined by reports made to the district proration committee. Producers who do not market through regular channels might receive allotments which would be transferable when their produce was sold.

Under the Agricultural Adjustment Act the Agricultural Adjustment Administration cannot limit, by license, the production of any individual farmer. The industry in the Southeast, in the light of its experience with the tobacco and cotton programs, considers this a weakness of the marketing agreement, and has expressed itself as desiring an individual allotment of acreage to each producer. It was the development of such a situation that was foreseen when certain amendments to the act were proposed at the last session of Congress. The fact that they were not adopted, however, has made it impossible for the Administration to

extend to the potato industry in the early and intermediate states the assistance for which it asks. Producers in the Atlantic Coast States, from Maryland south, have requested a thorough study of the situation, having in mind the possibility of again proposing legislation to make such allotments possible, or to make potatoes a basic commodity. The result of their activity in this direction is to focus attention upon the question of control of the potato industry for the whole United States.

When we consider a production control program for all potatoes, we are confronted with one of the most difficult problems in agriculture. Potatoes are grown in all forty-eight states and are produced somewhere during every month of the year. About twenty per cent of the crop is perishable, while the remaining eighty per cent is practically a staple commodity that can be held in warehouses throughout the winter. The perishable portion of the crop consists of about ten per cent grown in the early states and about eight per cent grown in the intermediate states. These percentages vary with the size of the northern crop held over, general business conditions, and the prospects for successful marketing during the spring and early summer. There are about three million potato farmers in the United States, and production averages slightly more than one acre per farmer. Possibly 120,000 farmers produce the bulk of the commercial crop which enters into carlot movement over greater or less distances. The portion of the crop grown for home consumption or local distribution is a factor that will vitally affect any program adopted because of the comparative ease with which this type of production can be expanded. The fact that such production has been increasing for the past ten or fifteen years, due to the advantage of farmers near large markets over more distant producers in the matter of freight rates, is one which causes a great deal of concern when any control program is considered.

It must be borne in mind that the demand for potatoes is inelastic, and there is no material expansion of consumption at low prices. Potato consumption is, of course, affected by business conditions to some degree, as well as by the quality offered, but cannot be materially increased by advertising or other such merchandising methods. It would seem, therefore, that an adjustment of supply to demand would be the most effective factor in influencing prices.

There is apparently a growing demand that production control be achieved through making potatoes a basic commodity. Such a program contemplates a reduction in acreage by the voluntary signatures of producers on acreage reduction contracts. It must be borne in mind that such a program, to be successful, would require some form of induce-

ment such as rental or benefit payments if sufficient contracts were signed to make it effective, or it would be necessary that Congress pass additional legislation penalizing non-cooperators by means of a tax on excess production, as has already been done in the case of the Bankhead Act for cotton and the Kerr-Smith Act for tobacco. Otherwise the excess produced by non-cooperators might nullify the effects of the plan. It must be pointed out that a basic commodity program is a voluntary one unless such additional compulsory legislation is passed. Since potatoes are not assembled at great central points for processing, and only about forty per cent of the annual crop is concentrated in even as simple a form as carload shipments, the difficulties of collecting a processing tax to be used in making benefit payments become apparent. Furthermore, up to the present time, with two exceptions, very little interest has been manifested by any of the late potato states in any form of control.

It is apparent that control of acreage alone will not bring about the desired adjustment of supply of potatoes to the market demand. The December crop estimate shows that the thirty late states increased potato production this year by 50 million bushels over 1933 on an acreage only fifty one thousand acres greater than last year. It would seem essential, therefore, that an acreage control program should also contemplate a regulation of shipments by some means, such as that provided for in marketing agreements.

Thus, it would be possible to maintain a double form of control of supply by stabilizing acreage within reasonable limits and then by adjusting supply to demand from week to week as the marketing period progresses. If such a program resulted in placing a higher average grade of potatoes on the market it should do a great deal to stimulate consumer purchasing through the improved quality of the product offered for sale. It would also eliminate the economic waste incurred in transporting and handling that portion of the present shipments which does not meet the minimum requirements of the U. S. No. 1 grade and, therefore, is an undesirable product on which to incur marketing costs in years of ample supply. The removal of such lower grade potatoes from the market supply would not only decrease the total shipments but would also prevent much of the market demoralization which results from the rejection of shipments containing undergrades.

The present situation of the potato industry is much more critical than appears on the surface. During three of the last four years, producers have received prices which have been ruinously low and in many sections some producers are actually on relief rolls. In the past entirely

too much consideration has been given to sectional advantages, the maintenance of the right to speculate, and the shipment of large volumes of potatoes to market regardless of whether the producer received any return from them or not. A satisfactory solution of the potato problem can be worked out only with the most searching analysis of the industry on a national basis and the development and application of those remedies which appear to offer the greatest hope for practical results in the various sections.

SOME RESULTS OF EXPERIMENTS WITH WIREWORMS IN NEW YORK STATE DURING 1934

W. A. RAWLINS AND G. F. MACLEOD

Cornell University, Ithaca, N. Y.

Continuing experiments of previous years, two new phases of studies with wireworms attacking potato tubers are of practical interest. A survey of eighteen potato fields at digging time yields some interesting quantitative data as to the species of wireworms and their injuries to tubers. More detailed studies of the activities of wireworm beetles and young larvae have contributed to a better understanding of control measures for these insects.

Since the results of the survey mentioned are discussed in some detail elsewhere* the conclusions only are presented here. Three species were found attacking potato tubers. Of these the wheat wireworm (*Agriotes mancus* Say) and the field wireworm (*Limonius ectypus* Say) were most abundant with an occasional field in which the corn wireworm (*Melanotus communis* Gyll) was doing some damage. Injuries and the larvae which caused them were decidedly more prevalent in low, poorly drained areas than they were on ridges of fields. Given the same number of larvae per hill of potatoes the wheat wireworm appeared most destructive, with the corn and field wireworm following in that order. With the wheat wireworm, increases in the proportion of tubers injured varied directly with the increases in numbers of larvae. In hills where less than four tubers were found the proportion of injured potatoes increased more rapidly for any given number of larvae than where four or more tubers occurred. If this holds true in more extensive studies the set of tubers on plants will materially affect the proportion injured by any given number of wireworms.

Previous studies indicated egg laying activities of wireworm beetles as a logical point of attack in the wireworm control problem. Accordingly, more detailed studies of the beetles were made during

*Jour. Ec. Ent. Vol. 28, 1935.

1934. Traps, consisting of shingles beneath which grass with both roots and tops was placed, attracted large numbers of beetles in infested fields which had been plowed. Results presented in table I show that most migration to the traps took place at night. Records from two fields (tables II and III) show that thorough cultivation of both a rye and a sod field resulted in sharp decreases in the numbers of beetles caught in traps. Observations indicate that some eggs were laid by these beetles under traps but no young larvae were found in these fields in the fall.

The effects of food on the survival of beetles in the laboratory (table IV) seemed to be quite marked. Apparently clover and timothy were of no food value for these adults, but molasses both increased the life span and the number of eggs laid by female beetles. The question of what food sources in the field correspond to molasses in these laboratory tests is one of considerable interest.

Numerous attempts have been made to determine factors responsible for the spotted nature of wireworm infestations within a field. A series of laboratory tests was conducted comparing soil from the potato fields which were infested, with soil from the same fields where wireworms were not found. The results (tables V, VI and VII) proved that beetles laid eggs indiscriminately on infested and uninfested soils nor was there any indication that young larvae survived or developed better in any one of these several soil types. Both survival and growth of larvae seemed more closely associated with the presence of food in these laboratory tests.

Considering the survival of newly-hatched larvae on various field crops, the data offered (table VII) are not comprehensive enough to warrant definite conclusion but it is interesting to note that, of all the trials made, only those larvae placed in sod were recovered. Continued tests of this type are being planned.

In general, the results of experiments with wireworms during the growing season of 1934 have confirmed earlier studies. The wheat wireworm appeared most injurious to potato tubers. Injuries to tubers were proportional to the numbers of larvae present in a hill. With any given number of wireworms there was a higher proportion of tubers injured where less than four potatoes per hill were found. Trap records proved that wireworm beetles migrate mostly at night. Cultivation of infested fields cleared those areas of beetles and although some eggs were laid none of the young larvae hatching from the eggs survived. Sod crops did, however, increase either the length of life or fecundity of beetles. Young larvae survived only in presence of grass roots as food. Eggs were laid and newly-hatched larvae survived

equally well on soils from spots in fields normally infested or unin- fested. It seems reasonably certain that infestations of the wheat wire- worm start and survive in sod lands. Early and thorough cultivation with the elimination of sod from potato rotations has afforded protection from infestation by the wheat wireworm.

TABLE 1—*Migration of beetles to traps during day and night periods.*

Date	Number of Beetles	
	Night	Day
May 26	21	6
May 27	45	5
May 28	74	12
May 29	67	7
May 30	109	12
May 31	93	5
Totals	409	47

TABLE 2—*Beetle trap records—Wilson field, 1934.*

Date of Baiting	No. of Beetles	Remarks
May 30	43	Beetles under rye
June 8	39	Same as above
June 16	23	Field harrowed. Rye clumps drying out.
June 22	24	No beetles in top soil Top soil dry. Beetles in rye clumps
June 29	2	Field harrowed. Rye clumps destroyed
July 5	0	Potatoes planted Soil dry.

TABLE 3—*Beetle trap records—Smith field, 1934.*

Date of Baiting	No. of Beetles Taken	Remarks
May 28	146	Soil moist Beetles under stones and lumps of soil
May 30	122	Same as above
June 2	176	Field harrowed Soil drying out
June 5	34	Potatoes planted Top soil very dry
June 13	1	Weeded Soil dry
June 27	0	Plants above ground Weeded

TABLE 4—*Effects of food on survival and oviposition of beetles.*

Treatment	Average Life (days)		Total No. Eggs	Average No. per Female
	Male	Female		
No food	11.2	15.7	263	29.2
Clover and timothy	11.6	14.2	135	9.0
Molasses	13.0	26.0	934	77.8

TABLE 5—*Comparative oviposition on infested and uninfested soils.*

Soil No.	No. Eggs	No. Females	No. Eggs per Female
1	1196	26	46.0
2	572	24	23.8
3	776	23	33.7
4	1169	24	48.7
5	659	27	24.4
6	803	22	36.5*
7	785	21	37.4*
8	543	25	21.7*
9	898	27	33.3*

*Normally infested soils

TABLE 6—*Survival of the newly hatched larvae with and without food.*

Soil	No Food	Clover and Timothy
1	0	22
2	1	19
3	0	9
4	0	13
5	0	29
6	0	26*
7	0	17*
8	0	15*
9	0	16*
Totals	1	166

*Normally infested soils

50 larvae in each test

TABLE 7—*Growth of larvae on clover and timothy.*

Soil No.	Large	Relative Medium	Size Medium	Small
1	7	8	4	2
2	6	8	4	2
3	4	2	2	1
4	1	4	6	1
5	13	11	3	2
6	9	11	4	1*
7	3	7	6	1*
8	2	8	4	1*
9	3	8	4	1*
Totals	48	67	37	12

*Normally infested soils

TABLE 8—*Comparison of the survival of young larvae (various crops).*

Crop	No. Introduced	No. Surviving	Survival Per cent
Sod	50	18	0
Potatoes .	125	0	0
Beans	125	0	0
Grain (stubble)	50	0	0

EFFORTS TO STABILIZE THE POTATO INDUSTRY IN CANADA

JOHN TUCKER

Central Experimental Farms, Ottawa, Canada

In order to comprehend the situation in Canada it is essential, first of all to review briefly potato crop production and distribution and then focus our attention on the principal area of instability and analyze reasons which resulted in the action taken to stabilize the industry. How effective action is simplified by the enactment of the Natural Products Marketing Act, 1934 is the principal feature of this discussion.

The 1934 potato crop of Canada is estimated at 80 million bushels, which is 10 per cent more than that of 1933 and 6 per cent above the average production of the five year period 1929-1933. The 1934 crop represents a production of approximately 8 bushels per capita.

The western half of the Dominion comprising the Prairie Provinces and British Columbia produced substantially the same quantity as in 1933 and is sufficient for the requirements of that area. The crop in parts of the Prairies was materially affected by drought and grasshoppers but the increase in this crop in British Columbia made up for this loss. The total production of potatoes for this entire area amounts to less than one-sixth of the total for Canada. No further mention will be made of this area.

The eastern half of the Dominion, comprising Ontario, Quebec and the Maritime Provinces (New Brunswick, Nova Scotia and Prince Edward Island) had a crop exceeding 67 million bushels as compared with approximately about 60 million bushels for the five year period 1929-1933, the crop being exceptionally good in the Maritimes. The usual fall export demand for Maritime table stock did not materialize, due to insufficient winter storage some of the stock had to be moved into Quebec and Ontario, but these markets were already well supplied with

locally-produced stock and prices dropped to unprofitable levels. Larger crops have been marketed before without so drastic a decline in price as occurred this season and it is felt by the producers and shippers that with proper organization the pressure on the markets can be relieved, and the rest of the crop marketed at more satisfactory levels.

Attention naturally centered on the Natural Products Marketing Act, 1934, which was passed at the last session of the Dominion Legislature, and which was intended to deal with just such problems. The fact that there were already five local boards in successful operation under this Act, viz. (1) Tree fruits effective August 28, 1934, British Columbia; (2) Fruit Exports, September 8, 1934, all provinces; (3) Red Cedar Shingle, October 16, 1934, British Columbia; (4) Dry Salt Herring and Salmon, October 22, 1934, British Columbia; (5) Flue Cured Tobacco, October 26, 1934, Ontario; was an added incentive to the producers of potatoes to apply through their respective provincial governments for a local board under the Act.

Representative growers and shippers from each province were assembled at Ottawa under the chairmanship of the secretary of the Canadian Horticultural Council, and the Act was outlined to them. Tentative plans were made to form a local board and a scheme to regulate the marketing of potatoes was outlined. The representatives returned to their respective districts to explain the proposed scheme. This season time did not permit the authorities to register the growers and record a vote as ordinarily required, but as many meetings as possible of producers were called and the proposed scheme fully explained. At practically all the meetings the response was favorable, (except possibly in Quebec which district has withdrawn for the time being), and the representatives again met at Ottawa on December 17, 1934, to present their reports, outline their program, and secure final approval for the establishments of the Eastern Canada Potato Marketing Board.

The following is an abstract of the scheme to regulate the marketing of potatoes grown in the Provinces of Prince Edward Island, New Brunswick, Nova Scotia and Ontario under the Natural Products Marketing Act, as it stood on December 17, the date this paper was prepared.

INTERPRETATION

Under this heading the words Act, Dealer, Eastern Canada, Grower, Local Board, Marketing, Member, Regulated Product, are defined.

DEFINITION OF THE SCHEME

The scheme is to reduce the ill effect on the market of the surplus of potatoes by,—

- (a) prohibiting the marketing of ungraded potatoes or potatoes of inferior grades;
- (b) prohibiting shipment on consignment;
- (c) orderly marketing;
- (d) increasing the consumption by publicity, advertising and other means;
- (e) developing export markets.

CONSTITUTION OF THE LOCAL BOARD

(1) There shall be a Local Board to be known as the Eastern Canada Potato Marketing Board, which shall consist of nine members, two of whom shall be elected by the registered growers in each of the following provinces: Prince Edward Island, New Brunswick, Nova Scotia, and Ontario. The ninth member shall be the Secretary of the Canadian Horticultural Council who shall also be the Chairman of the Board.

(2) Members shall be elected for a period expiring on July first in each year and shall be eligible for re-election; a member shall cease to hold office if he is convicted of any offense under the Act.

(3) Whenever there is a vacancy on the Local Board or whenever a member thereof is unable to perform the duties of his office, another member may be elected for the balance of the term by the original appointing authority of each member.

(4) Every registered grower shall be eligible to vote at any meeting called in connection with this scheme if at that time or during the year immediately preceding, he has or had two acres or more planted in potatoes.

(5) The Board shall be validly constituted and may function notwithstanding a vacancy therein, but in the case of a vacancy the Board shall immediately take steps to have the same filled.

EXERCISE OF POWER BY THE LOCAL BOARD

This deals with place of meeting, keeping of minutes, copies of minutes, orders and determinations to be supplied Dominion Marketing Board, audit, etc.

TOLLS AND CHARGES

The Dominion Marketing Board may establish a separate fund in connection with the scheme of regulation. For the purposes of such scheme the Board may impose charges and tolls in respect of the marketing of the whole, or any part of the regulated product not exceeding one-half of one cent per bushel. These charges and tolls shall be payable by such persons engaged in the production or marketing of the regulated product as the Board decides.

POWERS OF THE LOCAL BOARD

For the purposes of the scheme of regulation, the Dominion Board shall authorize the Local Board to exercise the following powers:

- (a) to regulate the time and place at which and to designate the agencies through which the regulated product shall be marketed;
- (b) to determine the manner of distribution of the regulated product, and more particularly under firm contracts;
- (c) to determine the quantity and quality, grade, variety or class of the regulated product that shall be marketed by any person at any time and to prohibit the marketing of any of the regulated product of any grade, quality or class;
- (d) to require each dealer engaged in the marketing of the regulated product to obtain a license from the local Board, which license shall be subject to cancellation by the Local Board in case of violation of any order or determination of the said Board;
- (e) to require all growers to register their names and addresses with the Local Board;
- (f) to require full information relating to the production and marketing of the regulated product from all persons engaged therein; and to require periodic returns to be made by such persons, and to inspect the records and premises of such persons;
- (g) to appoint from time to time an agent or agents to investigate and report upon the possibility of extending the market for the regulated product and to pay the cost of such investigation and report;
- (h) to act as the agent of the Dominion Marketing Board to collect charges or tolls imposed;
- (i) to disburse on account of organization, operation and other necessary expenses of the Local Board any fund or reserve created by

charges or tolls imposed in connection with the scheme of regulation;

(j) to employ such persons as are necessary for the purposes of the Local Board;

(k) to exempt from any determination or order (1) any person or class of persons engaged in the production or marketing of Potatoes; (2) any class, variety or grade of potatoes;

(l) to advertise the regulated product and pay the costs of same out of the funds of the Local Board.

Before July 10th, 1935, a poll of all registered growers shall be taken, to determine their wishes as to the continuation or termination of this scheme, and any additions or amendments thereto. If those favoring the scheme represent the necessary percentage required by the Minister, the scheme shall remain in force, subject to the provisions of the Act.

SUMMARY

Very wide powers are included in the Natural Products Marketing Act 1934, with a view to improving the methods and practices of marketing of natural products in Canada, and securing better financial returns to growers.

When a scheme has been approved by the Governor in Council the Minister gives public notice in the Canada Gazette and the provisions of the scheme as approved have the force of law. The Local Board, from the date of publication of the notice of approval, is a body corporate.

The Local Board does not actually market the product, but may regulate the marketing through channels already in operation, or otherwise, and may license dealers, register the growers, collect tolls, etc. It is intended that the scheme shall be entirely self supporting. In other words, very wide powers are granted to the producers to regulate, through their own elected board, the marketing of their products.

COOKING QUALITY OF CERTAIN POTATO VARIETIES AS INFLUENCED BY ENVIRONMENT.

E. J. STEVENSON, *Geneticist, Bureau of Plant Industry* and ELIZABETH FULLER WHITMAN, *Bureau of Home Economics,
U. S. Department of Agriculture.*

In the production of new varieties of potatoes with disease resistance higher yield and other characters of economic importance, table quality is one of the most important as well as one of the most difficult complexes with which the potato breeder must work.

The potato in commercial practice is clonally propagated and, theoretically, wide variations in character expression should not be found within the clon. On the contrary, the characters which are combined in what is known as table quality are subject to variations from many sources. Starch content and other chemical constituents, texture, flavor and color of flesh must all be given consideration in any estimation of quality. All of these characters are more or less subject to variation even in tubers of a clonally propagated line.

Some of the environmental factors which are said to affect these characters are: The physical and chemical make-up of the soil, the kind of fertilizer used, climatic conditions and cultural methods such as depth of planting and state of maturity at harvest time, and in irrigated sections the rate and time of application of irrigation water. Storage conditions, especially storage temperatures, contribute to the variability. Variations due to cooking methods and to different preferences of judges add further to the complexity of the problem.

Soil texture is given as a contributing factor by Gilmore (5) who cited an instance where potatoes grown on Elmira clay loam of poor drainage were of poor cooking quality and almost unpalatable because of their flavor, but tubers grown on Miami fine sandy loam were pronounced very good. He stated also that quality is influenced by degree of ripeness and depth of planting. Tubers grown at a depth of from 2 to 5 inches were superior in quality to those planted shallower or deeper. Fitch and Bennett (4) gave the proportion of starch to other constituents, size and number of starch granules, degree of ripeness and flavor as factors influencing quality. They also reported that where early irrigation can be practiced and tubers can be set early they reach fuller maturity and finer quality. Ashby (1) found that potatoes of good cooking quality showed a higher dry matter content than those of inferior quality. The potatoes of good quality showed further a higher non-protein nitrogen and correspondingly lower protein nitrogen content than those of poor quality. Whittemore and Kuschke (7) reported that boiled, mashed or baked potatoes were more mealy when

they were grown in plots fertilized with a high quantity of potash, and that when the potash was applied in the form of potassium muriate more mealy potatoes were produced than when potassium sulphate was applied. Findlay (2) lists the following as the chief factors that affect quality: variety, kind of soil and season, maturity, time of planting, sprouting the seed and fertilizing. Early-planted, sprouted seed gave extremely dry mealy potatoes, while late-planted, unsprouted seed of the same varieties gave wet, soapy tubers. Good quality potatoes of main crop or late types were obtained when well-sprouted seed of a suitable variety was planted in April on comparatively light soil which was dressed with a complete fertilizer (sulphate of ammonia, superphosphate and sulphate of potash), in seasons in which the weather conditions were such that the tubers reached full maturity.

That there are many environmental factors which influence the cooking quality of the potato is well known. It has been recognized too that varieties possess inherent differences in quality which are very pronounced when they are grown under similar conditions. It should be remembered, however, that a variety of potatoes which produces tubers of excellent quality when grown under one set of conditions may be very poor in quality under other conditions. Another variety may produce tubers of fair quality under average conditions, but under exceptionally good conditions the quality may be very good.

From the plant breeding standpoint it is desirable to know how much a clonal line will vary in quality when grown under conditions found in various potato growing sections in the United States and to determine, if possible, whether some varieties are more susceptible to environmental changes than others. In this study an attempt has been made to measure the variability and to determine the factors which contribute to this variability in a cooking test.

MATERIALS AND METHODS

In 1932 Katahdin, a new variety of potatoes produced by the United States Department of Agriculture was tested in 17 states and at Winnipeg, Canada.

In 1933, another new variety, Chippewa, was grown in 14 states. In 24 locations in these states, in all, Green Mountains and Russet Burbanks were grown also, in order that the cooking quality of these two standard varieties could be compared with Chippewa and to ascertain if the variability due to widely varying conditions of environment was greater for one variety than another.

At harvest time approximately 20 tubers of each variety from each of the tests were shipped to Washington. These were cooked in most cases as soon after they arrived as possible. Those which could not be cooked with-

out delay were stored for a brief time at a temperature of from 60-65°F., the high temperature being used to avoid deterioration in quality due to the accumulation of sugars.

Five judges reported independently on the quality of each sample. Since Katahdin was grown in 1932 and Chippewa, Green Mountain and Russet Burbank were tested in 1933, the analysis for Katahdin is given separately. Thirty-two tests of this variety were grown in as many different locations. Five judgments were obtained for five samples of four tubers each from each location giving in all a total of 800 judgments. Six of the judgments were not recorded so that a hypothetical value had to be given for purposes of the analysis. The average of the judgments for the other four samples from the same location was used. In a few instances a substitute had to be used for the regular judge. This may have increased the error somewhat but no consideration of it could be given in the analysis. The analysis of the data was made according to the method outlined by Fisher (3) for dividing the variance into its component parts and the probabilities of significance were determined by the use of Snedecor's (6) tables for values of F.

In the tests of Katahdin the lots from each of the 32 locations were divided into five samples of four tubers each on the basis of size. This was necessary since the four tubers of a single sample were cooked together and had to be comparatively uniform in size in order to be uniformly done at the end of the cooking period. All samples were steam cooked to an interior temperature of 96° C.

The samples were numbered so that identification with reference to location could not be made by the judges. The judges reported independently on the quality of each sample. The final scores of quality of the mashed flesh as a food product were given in five classes.

RESULTS

The data for cooking quality of the Katahdin grown in 32 locations in 1932 are given in table 1.

TABLE 1—*Cooking quality of Katahdin grown in 32 locations in 1932.*

Classes	Very poor	Poor	Fair	Good	Very good	Total	Weighted-Av.
Class values	1-1.5	1.6-2.5	2.6-3.5	3.6-4.5	4.6-5.0		
No. of judgments	146	244	202	156	52	800	2.66
No. samples	15	64	44	33	4	160	
No. of lots, 1 lot from each location	1	15	9	7		32	

It is seen that with reference to individual judgments and samples of four tubers each that Katahdin varied in cooking quality from one extreme to the other. The lots from the 32 locations are found in 4 classes. No lot of 20 tubers was found in the highest class although 4 samples of 4 tubers each were found in it. That there is wide variation is quite evident, but it is also important to analyze this variation in an effort to determine within the limits of the experiment some of the elements which have contributed to it. This analysis is given in table 2.

TABLE 2.—*Analysis of variance for cooking quality of Katahdin grown in 32 locations in 1932.*

Sources	Degrees of Freedom	Sum of Squares	Mean Sum of Squares	F
Judges	4	65.01	16.25	37.79 (1)
Locations	31	622.78	20.09	46.72 (1)
Judges' Locations	124	132.99	1.07	2.49 (1)
Error	640	276.00	.43	
Totals	799	1096.78		

(1) Exceeds the 1% value for F.

The F value of judges as compared with error greatly exceeds the 1% requirement. The judges in these tests therefore were judging by different standards, that is, some of them were consistently lower in their estimation of the quality of the samples than others. This is a situation which may occur in any cooking test since the individual preference of the judges differ. In this test the average of the 800 judgments may not give the true value of the Katahdin variety of potatoes as grown at the 32 different locations. As the main object of the experiment, however, was to determine the range of variability due to the various environmental conditions found in the locations in which the potatoes were grown, the comparisons among lots from these places can still be made since it is shown that the judges were consistent in following their own standards.

The F value for locations compared with error is so large that there is not one chance in a hundred that the differences are random. If two lots differ by one class the difference is highly significant even if the total variance is used in the determination of the standard error. In this case the standard error of a single determination is 1.37. The standard error of the mean of 25 judgments or of a lot from one loca-

tion is .274. Twice the standard error of a difference between two such lots is .548. If two lots each from a different location differ by .548 of a class the odds are approximately 19:1 that the differences are not due to chance alone. On the same basis the odds are much greater that if two lots differ by one whole class that this difference is significant. It is seen then that the quality of this variety of potatoes varied through four out of a possible range of five classes grown in only 32 locations.

This being true it was considered advisable to determine whether or not other varieties responded to their environment in a similar manner. Three other varieties, Chippewa, Green Mountain and Russet Burbank were tested in 1933. These were grown in 14 states in a total of 24 locations.

Table 3 shows the range of judgments of each of these varieties for the places grown:

TABLE 3

TABLE 3—*Cooking quality of Chippewa, Green Mountain and Russet Burbank grown in 24 locations in 1933.*

	Classes	Very poor	Poor	Fair	Good	Very good	Total	Weighted Average
Chippewa	Class val.	1-1.5	1.6-2.5	2.6-3.5	3.6-4.5	4.6-5.0		
	No. of judgments	22	158	273	139	8	600	2.92
	No. of samples	2	27	67	24		120	
	No. of lots							
Green Mountain	1 lot from each location		5	14	5		24	
	No. of judgments	5	64	197	250	84	600	3.57
	No. of samples		11	37	63	9	120	
	No. of lots							
Russet Burbank	1 lot from each location		1	6	16	1	24	
	No. of judgments	15	53	190	204	138	600	3.66
	No. of samples	1	8	44	43	24	120	
	No. of lots							
	1 lot from each location		1	8	12	3	24	

The individual judgments in each case extend through the whole range of classes. This is true too with reference to the samples of 4 tubers each with the exception of Green Mountain, in which case no individual sample was found in the lowest class. The 24 lots of Chippewa extended through three classes with a weighted average of 2.92. Green Mountain is found in 4 classes, with a weighted average of 3.57 and Russet Burbank is found in the same 4 classes as Green Mountain with a weighted average of 3.66. The analysis of these tests is given in table 4.

TABLE 4—*Analysis of variance for cooking quality of Chippewa, Green Mountain and Russet Burbank grown in 24 locations in 1933.*

Sources	Degrees of Freedom	Sum of Squares	Mean sum of Squares	F
Judges	4	6.52	1.63	4.18 (1)
Locations	23	513.70	22.33	57.25 (1)
Varieties	2	196.01	98.00	251.28 (1)
Judges Locations	92	130.07	1.41	3.62 (1)
Judges Varieties	8	2.71	.34	.87 (2)
Locations Varieties	46	200.39	4.36	11.18 (1)
Error	1624	639.02	.39	
Total	1799	1688.42		

(1) Exceeds the 1% value for F.

(2) Is less than the 5% value for F.

The judges were judging by different standards again but were consistent in their work as shown by the comparison of the variance due to judges and that due to error. The interaction between judges and varieties is not significant showing that one judge did not prefer one variety and another a different variety.

The F for locations compared with error is highly significant, indicating as in the Katahdin tests that the environmental conditions cause significant variations in the cooking quality of these three varieties. One variety is, however, higher in cooking quality on the average than another as is shown by the high value of F for varieties compared with error. The interaction between varieties and locations is also significant, showing that in some locations one variety is higher in quality than another while in other locations the reverse may be true.

DISCUSSION AND SUMMARY

The potato breeder is confronted with a constant demand from growers and dealers for potatoes with higher cooking quality. This demand often takes definite form in a statement such as "We want varieties with the cooking quality of the Russet Burbank or the Green Mountain." The study reported here has shown that Russet Burbank, Green Mountain, Katahdin and Chippewa varieties grown under certain conditions are relatively high in cooking quality but grown under other conditions the quality of any one of them may be poor. Variations of a nature similar to those found here have been observed before but in this study an attempt has been made to measure the variability and to analyze the variance. The F value for judges compared with error indicates that the judges were judging by different standards but that they were consistent in following their own standard.

It is significant that samples of each of the varieties tested varied almost from one extreme to the other in a scale of five classes in spite of the fact that the tubers were grown in comparatively few locations. The significance of these variations is shown in the high F value for locations.

The inherent differences among the varieties are apparent in that one variety tends to maintain better quality than another over a wide range of conditions, as shown by the high ratio obtained between variance due to varieties and variance of error. A significant interaction between varieties and locations indicates varietal adaptation so that if comparisons are to be made between two varieties it must be known that they were grown under very similar conditions.

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SECTIONAL NOTES

LOUISIANA

The planting of the spring crop of potatoes is now under way and the indications are that the acreage will be 20 to 30 per cent less than the past five year acreage. The decreased acreage is largely accounted for by a shortage of certified seed and the prevailing high prices. As the result of this there will be more Louisiana certified and home-grown fall potatoes planted this year than usual. (Feb. 12).—JULIAN C. MILLER.

MAINE

Over 2,500 attended a potato meeting held at Presque Isle on February 4th to discuss National legislation for the potato industry, the potato outlook, an industry council, and a proposed state branding law.

Congressman Ralph O. Brewster explained the legislation which it is hoped congress will enact. The meeting went on record as supporting the effort to make potatoes a basic commodity and of supporting the Warren Bill featuring the provisions of the so-called Kerr-Smith tobacco act.

A. E. Mercker gave the potato outlook for 1935 and told something of the marketing agreement of the early states.

Dean A. L. Derring, of the College of Agriculture, emphasized the need of an organization composed of all the varied interests in the county. Plans were formulated for a council composed of representatives of various organizations in the county which could be expected to unify the industry.

Commissioner Frank P. Washburn explained the provisions of the branding law which is before the state legislature and the meeting unanimously endorsed this act. He also endorsed the idea of a council for the county.

The results of the meeting indicate that the county will back any sound movement that can be expected to improve the potato situation.—VERNE C. BEVERLY.

Present shipments out of Maine are running the heaviest on record, 400 cars per day being about the average. This is exceeding expectations of every one. While part of this heavy tonnage is due to shipments of both selected and certified seed sold earlier in the season, table stock shipments are running heavy also. One

satisfactory phase of this heavy movement is that demand is not decreasing but seems to be holding fairly steady on both table and seed potatoes.

To date, February 16, we are approximately 3,000 cars ahead of last year, with total shipments slightly over 31,000 cars. If the markets can absorb the balance available for shipment the majority of well-informed shippers and growers believe there will be between twenty-five and thirty thousand cars to ship yet. The amount that will be shipped depends greatly, of course, upon the progress of the early producing sections.

Seed shipments are running one hundred eighty-six cars of Certified stock ahead of last year. The demand is good now, but prices have been driven down to the lowest point of the season. For the last four years this same situation has been true, namely: between the Eleventh and Twentieth of February prices of seed have touched the lowest prices of the season. There are indications today that some improvement is coming, although slight as yet.

To the surprise of all concerned, Spaulding Rose has shown increased strength following the buying in the Hastings Florida district. This is due entirely to shipments of Spaulding Rose to Chicago at slightly better prices than table stock Mountains are netting. This situation rarely, if ever, has occurred before. Selected and Certified Bliss have been holding at high levels all the season as has also Katahdins, illustrating the old rule that whenever there is a scarcity of any commodity, prices correspondingly rise.

A considerable volume of seed was sold early in the season at the time when the effects of the Western drought on the potato crop were more apparent than real. For the most part shippers here have been able to complete their contracts. There have been some exceptions of course, but the Southern receivers have taken their medicine for the most part.

The present adversity for the Maine growers is not without its beneficial effects. They are showing increasing evidence of willingness to get together on programs helpful to the industry. Legislation will probably be passed at this session of the State Legislature with the enthusiastic backing of the growers requiring the true branding of all shipments. This will necessitate increased use of the Federal State inspection service and much more care in grading. Coupled with this True Branding law, so called, is a provision for emergency application for the balance of this present season. There is very good reason to believe that in ad-

dition there will be an appropriation of \$50,000 to advertise our best quality Maine potatoes providing the True Branding Law is approved. These measures should result in a great improvement in the Maine potato industry. (Feb. 16).—FRANK HUSSEY.

OREGON

The outstanding feature of Oregon's 1934 potato crop was the excellent quality in the Klamath Basin in eastern Oregon. Ten years ago, there were no shipments from Klamath County. The 1934 crop will probably result in shipments of about 5,000 carloads. Normally, the Klamath crop has been marketed from Bakersfield, California, north to Eugene, Oregon. This section will take about 4,000 cars of quality potatoes in addition to the long Whites which are grown in the vicinity of Stockton, California, which is nearly in the center of the territory as outlined. In all of this territory Klamath has a trade advantage over all competing sections, except Stockton. The natural competing areas are the Idaho shipping points and Yakima, Washington. The result has been that growers in Klamath County have consistently received 15c or 20c more per hundred for their Netted Gems than have the Idaho Yakima growers for potatoes of the same variety. Growers so far have been receiving from 75c to 85c a sack for U. S. No. 1. More than a hundred cars were bought for January delivery at \$1.00 a sack to the growers.

Most of the cellars in Klamath are sorting out from 80 to 90 per cent U. S. No. 1 and the size is excellent. Some of the buyers are sorting out the No. 1 potatoes weighing from 12 ounces up and are selling them to the restaurant trade at an advance over the regular U. S. No. 1 price of about 20 or 25c. On the Pacific Coast these very large potatoes were sold as "bakers" although the restaurants may use them mostly for French fried and other purposes.

Practically all the Klamath farmers own large potato storage cellars holding from 15 to 50 or more carloads. Most of the dealers operate their own large power-driven sorters and a common method of buying is for the dealer to buy the potatoes at the cellar, pay the farmer for No. 1's and 2's and then do all the sorting, furnish the sacks, do the trucking and the loading. Other farmers prefer to do their own sorting and in such cases own power-driven sorters themselves.

This concentration of Oregon potato industry into one rather

small area is indicative of what is going on nationally in potato production. The entire crop tends year after year to be concentrated more and more in certain areas where production conditions are especially good. Thus the entire commercial potato crop in the Pacific Coast states is now pretty much concentrated in the areas of Stockton, California; Klamath, Oregon; Yakima, Washington; and the larger Idaho territory from Idaho Falls to Twin Falls.

Oregon still continues to grow 400 or 500 carloads in other sections of the state which are mainly used for seed for shipment to California, Washington, and Idaho points.

Prices for certified seed, to date have not exceeded \$1.00 per hundred for Burbanks and Netted Gems and \$1.25 for early varieties. (Jan. 29).—E. R. JACKMAN.

PENNSYLVANIA

The annual meeting of the Pennsylvania Potato Growers' Association was held on January 22 and 23 at Harrisburg in the \$1,500,000 Farm Show Building which covers approximately ten acres of ground. The entries in the potato show were of excellent quality and showed painstaking and careful efforts on the part of the grower in their selection. A. W. Smithbauer, Loretto, Pennsylvania, a certified seed grower from Cambria County, was awarded the grand championship for his entry of white rurals.

The first results of E. L. Nixon's breeding work were unveiled and presented. A new variety of potato developed by Doctor Nixon was christened the Nittany Cobbler. After inspiring and impressive ceremonies the potatoes were sold to the highest bidder. Mr. W. C. Deebel of Schuylkill County took the honors by bidding \$26.00 for the lot which contained approximately three pecks of tubers. The association also voted to establish a graduate student fellowship at the Pennsylvania State College to assist Doctor Nixon on his potato breeding work. This fellowship will run for one year and will carry approximately \$1,200, half of which will come from the treasury of the association. A number of growers and potato dealers offered to subscribe amounts up to \$25 if any additional funds should be needed.

As in previous years the association maintained a "Baked Potato Booth" at the Farm Show where potatoes were baked and sold at five cents each. Approximately 22,000 Pennsylvania-grown baked potatoes were sold. The cost connected with putting on a

booth of this kind is rather high but the growers have always felt that their efforts are well worth while even though they cannot do more than break even financially on the project.

This project proves one thing in the minds of Pennsylvania growers "that people still like potatoes and are eager to buy them if they are made attractive." (Feb. 4).—K. W. LAUER.

VERMONT

With little dissent Vermont potato growers at the Union Agricultural Meetings at Burlington last month went on record as favoring having potatoes made a basic commodity with some form of production control. Since the invitation to the meeting had been made general to all seed and table stock growers in the state and was well attended, this action may be regarded as fairly representative.

This should not be taken to indicate that Vermont growers are enthusiastic about the general principles of regulation of agriculture through or by the government. There was decided expression to the contrary. With, however, some crops set up as basic commodities it appeared to most of those speaking at this meeting that potato growers must see to it that their product is included as a matter of self protection.

It seems probable that the proposed Warren bill may answer the purpose they have in mind.

Two years ago the Vermont Department of Agriculture adopted the set of certification standards which were drawn up and agreed upon at the New Brunswick, New Jersey, conference in March, 1932. These standards have proved to be entirely workable and satisfactory and no changes are contemplated for the coming year.

The preliminary requirements as to a central test plot and tuber units in each field which were in force before the adoption of the New Brunswick standards have been continued with them. Each lot of seed planted has to be represented by a 100-tuber sample in a state supervised central test plot and each grower is required to plant 200 tubers in units which may not be rogued prior to the first inspection. (Feb. 5).—HAROLD L. BAILEY.

WASHINGTON, D. C.

Those interested in certified seed potatoes should acquaint themselves with the code of Fair Competition for the wholesale

Fresh Fruit and Vegetable Distributive Industry. In discussing the provisions of the code, R. C. Butner of the Agricultural Adjustment Administration recently stated.

The term "certified" in connection with the sale of seed potatoes has been greatly misused by the fruit and vegetable industry. The Code makes it an unfair trade practice to "use the term 'certified' or any term or statement which would indicate official certification in connection with the sale or offering for sale of any fresh fruits and/or fresh vegetables except those certified by an officially approved State or Federal Agency." Many cars of ordinary potatoes have been substituted for and sold for "certified" seed potatoes, such practice being a deception and a fraud. This provision of the Code should result in the elimination of unfair competition and make it possible for producers of seed potatoes which have been certified by an officially approved agency to obtain better prices. The practice of making false and misleading statements in this connection should be corrected immediately, and this provision of the Code is highly commendable.

Violations of the trade practice provisions of the Code should be reported to the code authority, of which L. J. Keach, 108-112 South Delaware Street, Indianapolis, Indiana, is Chairman. Mr. E. W. J. Hearty, 99 Hudson Street, New York City, is the executive director of the code authority. The Agricultural Adjustment Administration desires to eliminate the unfair trade practices which are prohibited by the code, many of which work to the disadvantage of the producers of fruits and vegetables as well as those members of the industry who are engaged in distribution in the terminal markets.

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GOOD NEWS

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POTATO GROWERS, searching for a bright spot in the present situation, will find that the biggest and best news in the new fertilizer price lists is the very small difference in cost between a low-potash fertilizer and a fertilizer well-balanced with plenty of potash. Potash is cheaper today than ever before in history. It is the cheapest unit of plant food the farmer can buy.*

For example compare 4-8-7 fertilizer with 4-8-10 fertilizer. The 4-8-10 contains 15% more actual plant food, yet it costs the farmer only a fraction more than the 4-8-7. Figured in terms of an acre the extra cost is so small it will surprise you.

This is good news because potash is the most important plant-food element in the production of good yields of a high-quality potato crop. Potatoes remove from the soil more potash than both nitrogen and

phosphoric acid combined. If the fertilizer is not well-balanced with plenty of potash, potato plants have a tendency to make too much vine growth at the expense of the tubers.

Potash is the quality-producing element in potato fertilizer. It reduces the culls and produces No. 1 potatoes that are smooth, chunky and uniform—of better color and more even maturity. Potash-fed potatoes have a high-starch and low-protein content. When cooked, these potatoes are white, mealy and palatable.

The potato grower's best opportunity for success this season is to keep costs low and grades high. The extra yields and extra quality added at such low cost by extra potash are usually the most economical share of the crop. This is doubly true this year when potash is so cheap.
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American Potato Journal

PUBLISHED BY

THE POTATO ASSOCIATION OF AMERICA
SOMERVILLE, N. J. NEW BRUNSWICK, N. J.

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PROPOSED CONTROL PLANS

The plan to make potatoes a basic agricultural commodity is being considered favorably by some states while others are very much opposed to it. In view of this fact, even if the proposed control act should be adopted, there is some question concerning the advisability of attempting to enforce it this year. Before the plan is put into effect the growers in the various areas should be given an opportunity to vote on whether or not they want it. It is questionable if a true expression of the growers' reaction can be obtained in any other way.

In addition to the proposed national control plan various other attempts are being made to improve the industry. In Washington, the certified seed growers are now operating under a marketing agreement which determines minimum prices and terms of sale of seed; these prices to be based on production cost, cost of marketing, storage and shipping expenses, etc.

In Virginia the credit agencies have agreed to reduce the credit extended by them so that the acreage planted will be reduced to a minimum of twenty-two per cent on the Eastern Shore of Virginia, and a minimum of ten per cent on the Eastern Shore of Maryland.

In Maine, an act has been introduced in the legislature which provides for the establishment of grades and branding. A request is also being made for an appropriation of \$50,000 to advertise Maine potatoes.

In New Jersey the marketing plan of the past two years is to be continued since the New Jersey growers are convinced that the adoption of this plan will result in increased returns.

These attempts demonstrate that the growers appreciate that steps should be taken to improve the industry. The various movements started by the growers in different sections are steps in the right direction.